REMARKS

Applicants thank the Examiner for the phone interview of April 30, 2004. The substance of the interview is summarized by the following remarks.

New claims 19 and 20 are added. Support for new claims 19 and 20 can be found, for example, on page 4 of the specification.

New claims 19 and 20 are allowable over Bornstein et al., WO 93/24683, because Bornstein et al. requires the presence of either Mg or Ca in the alloy. (See pg. 6, lines 10 – 11 and the abstract regarding substitution of Ca for Mg.) Bornstein et al. describes that special casting methods are required to properly incorporate the Mg (or Ca) into the alloy. To make the alloys in Bornstein et al., either a mold having a magnesium bearing ceramic material in a face coat must be used (pg. 4, lines 16 – 25), or a modified casting process must be used to prevent excessive loss of magnesium in the single crystal casting process (pg 6, lines 12 – 21). By contrast, claims 19 and 20 are directed to an alloy that does not contain either Mg or Ca. Applicants acknowledge the alloys of Bornstein et al. in paragraph 011 on page 3 of the specification as filed. Applicants then state that an objective of the invention is to provide an alloy that is easy to cast. (See end of paragraph 012 on page 3 of the specification.) Excluding Mg or Ca avoids the need for the specialized casting processes described in Bornstein et al. Thus, the specification provides a clear indication that having an alloy that is easy to cast is one of the basic and novel characteristics of the invention. This satisfies the requirement in MPEP § 2111.03 of clearly indicating what the basic and

novel characteristics of an invention are when determining the scope of a claim using the transitional phrase "consisting essentially of." Based on the above, claims 19 and 20 should be construed to exclude alloys containing Mg or Ca, and therefore are allowable over Bornstein et al.

The rejection of claims 1, 2, and 4 – 18 under 35 USC § 103(a) over Bornstein et al. is respectfully traversed. The claimed invention requires an alloy having an Re content of at least 2.3 wt% and a weight ratio of Re to W of 1.1 to 1.6. As detailed in the specification and the supporting declaration by Dr. Thomas Mack, an alloy according to the claimed invention combines the beneficial properties of having a high creep strength (Fig. 2 of Mack declaration) while maintaining a low density and a low material cost (Table 1, Fig. 1 of Mack declaration). By contrast, Bornstein et al. describes an alloy that is designed to have a high oxidation resistance. (See Title and Abstract.) Bornstein et al. provides no teaching or suggestion of how to create alloys with improved creep strength or reduced density relative to other alloys. Bornstein et al. also provides no indication of the importance of an Re content of 2.3 wt% or of maintaining a weight ratio of Re to W of 1.1 to 1.6 for achieving improved alloy properties.

In paragraph 4 of the Office Action, the Examiner raised a number of issues regarding the declaration of Dr. Thomas Mack. These issues are addressed in the order raised in the Office Action.

I. In Table 1, all of the LEK94 alloys and the Experimental alloys were actually prepared. In Figures 1 and 9, the LEK94 specimen used is the "nominal" alloy shown in Table 1.

The Bornstein et al. and Nguyen-Dinh alloys were not prepared. Instead, the density for these alloys was calculated based on the composition as shown in Table 1. Note that the SXref composition and the Bornstein et al. "nominal" composition are the same except for the Mg content.

II. The Office Action notes alloys SX3 – SX6 as being representative of the claimed invention. However, the LEK94 low, high, and nominal alloys are also representative of the claimed invention. The LEK94 alloys have Al weight percents of 6.2 – 6.8; Cr weight percents of 5.8 – 6.4; and Co weight percents of 7.2 – 7.8 Additionally, the LEK94 low, high, and nominal alloys have densities similar to the densities for SX3 – SX6. Thus, at a minimum the declaration is commensurate in scope with claims 5 and 12.

More generally, the claimed invention is drawn to an alloy containing at least 2.3% of Re and containing W and Re in a weight ratio of 1.1 to 1.6. The declaration provides examples of at least 7 alloys meeting these characteristics (LEK94 low, med, and nom; and SX3 – SX6) Thus, the declaration is generally commensurate in scope with the claimed invention.

III. Applicants respectfully disagree that claims 2 and 18 do not limit the amount of tungsten. Claims 2 and 18 require that the weight ratio of Re to W is 1.1 to 1.6. Claims 2 and 18 also require an Re weight percent of 2.3 – 2.6%.

Based on these two limitations, claims 2 and 18 require a W weight percent of about 2.5 to about 4.2. The declaration shows at least 6 alloys that match the Re weight percent and Re to W weight ratio required by claims 2 and 18. (LEK94 low, high, and nom, SX3, SX5, and SX6) These 6 alloys show a range of tungsten weight percents from 3.0 to 3.7%. Thus, the declaration is commensurate in scope with claims 2 and 18.

IV. Applicants agree that the alloys SX1-A, SX1-B, SX1-C, and SX2 all have compositions within the broad range disclosed by Bornstein et al. The Examiner notes that alloys SX1-A, SX1-B, SX1-C, and SX2 also have densities of 8.15, 8.17, 8.16, and 8.21 g/cm^3. Applicants agree that the density values for SX1-A, SX1-B, and SX1-C are similar to the density values for the alloys representative of the claimed invention, LEK94 and SX3-SX6. Due to a high Re content, the SX2 alloy has a similar but higher density than the alloys of the claimed invention. However, the density values for all of these alloys should be considered in conjunction with the data shown in Figure 1 and Figure 2. The data points in Figure 1 and Figure 2 correspond to the same alloys described in Table 1. Note that Figure 1 shows each of the SX alloys using a black diamond symbol. The bottom axis of both Figures 1 and 2 is Re-content in wt%. The data points shown in Figure 2 correspond to the same Re-content values as the data points shown in Figure 1. Thus, in both Figures 1 and 2, the data point at an Re-content less than 2.0 corresponds to SX1-A, the next data point corresponds to

SX1-B, and so on until the last data point at an Re-content of greater than 2.9, which corresponds to SX2.

The alloys SX1-A, SX1-B, and SX1-C all have a lower Re-content than required by the claimed invention. Figure 2 shows that alloys SX1-A, SX1-B, and SX1-C have a noticeably reduced creep strength, as indicated by the time required to reach 2% plastic strain. Figure 2 shows a clear plateau in the creep strength that is achieved by having an Re content of 2.3% or greater. The alloys SX1-A, SX1-B, and SX1-C all have Re contents less than 2.3%, and thus have the reduced creep strengths shown in Figure 2. Thus, Figure 2 shows the distinction between the alloys of the claimed invention and the alloys SX1-A, SX1-B, and SX1-C.

The alloy SX2 has a higher Re and W content than is permitted in the claimed invention. As shown in Table 1 and Figure 1, this higher Re and W content leads to increases in both the density (8.21 g/cm^3) and cost of the SX2 alloy relative to the alloys of the claimed invention. Thus, the alloys of the claimed invention achieve a balance between having a high creep strength while maintaining a lower density and having lower material cost.

The alloy densities shown in Table 1 for the LEK94 and Experimental alloys are measured densities. The densities shown for the Bornstein et al. and Nguyen-Dinh et al. alloys are calculated densities. Note that the calculated density for the Bornstein et al. nominal alloy (8.56) is nearly identical to the measured density for the SXref alloy (8.55). As detailed above, the SXref and

Bornstein et al. alloys differ only due to a small Mg concentration (.004 wt%). As shown in Table 1, the alloys corresponding to the claimed invention (all LEK94 alloys, SX3 – SX6) show a reduction in density of 3% or greater relative to the densities calculated for the Bornstein low, high, and nominal alloys.

V. As noted above, the alloy compositions of the black diamonds in Figure 2 of the declaration correspond to the alloys SX1-A, SX1-B, SX1-C, and SX2 – SX6. The data points in Figures 1 and 2 are correlated as described above.

VI. Figure 5 shows an effort to fit quadratic curves to the $t_{1\%}$ and $t_{2\%}$ data shown in Figure 4, as a function of the weight ratio of Re to W in the alloys shown in Figure 4.

VII. The "coating" referred to in Figure 9 of the declaration refers to an aluminide coating, as discussed in connection with Figure 8. In some practical embodiments, the alloys of the claimed invention will be used as the bulk material for a machine part with a coating of a different composition. Figures 8 and 9 show differences between a conventional alloy and the alloys of the claimed invention when such a coating is applied.

With regard to TCP needle phases – TCP needle phases form during growth of a material due to insufficient stability of the desired phase. In Figure 9, the LEK94 alloy (representative of the claimed invention) shows TCP needle phases only at the interface with the coating. These TCP needle phases near the coating boundary are believed to be caused by diffusion between the coating and the bulk material. However, the LEK94 alloy shows no TCP phases in the bulk

material. By contrast, the SXref alloy also has TCP needle phases throughout the alloy bulk.

TCP needle phases in an alloy typically contain higher concentrations of refractory elements, such as Mo, W, and Re. When TCP phases are present in the bulk material, this indicates that the concentration of refractory elements is lowered in the rest of the bulk material, leading to a lower strength for the bulk material. The absence of TCP phases in the bulk material for the LEK94 alloy shows that the alloys of the claimed invention provide an alloy with a higher phase stability and higher mechanical strength.

VIII. The Examiner notes that the examples on pages 8 and 9 of the declaration show only a single composition of LEK94. Taken as a whole, however, the declaration provides examples of how various embodiments of the claimed invention are superior to the broad range of alloys disclosed by Bornstein et al.

For at least the above reasons, reconsideration and withdrawal of the rejection over Bornstein et al. is respectfully requested.

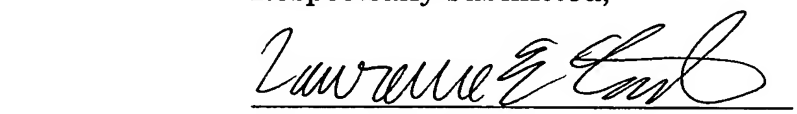
In view of the foregoing amendments and remarks, the application is respectfully submitted to be in condition for allowance, and prompt, favorable action thereon is earnestly solicited.

If there are any questions regarding this amendment or the application in general, a telephone call to the undersigned would be appreciated since this should expedite the prosecution of the application for all concerned.

If necessary to effect a timely response, this paper should be considered as a petition for an Extension of Time sufficient to effect a timely response, and please charge any deficiency in fees or credit any overpayments to Deposit Account No. 05-1323 (Docket #038741.50807).

Respectfully submitted,

August 11, 2004



Donald D. Evenson
Registration No. 26,160
Lawrence E. Carter
Registration No. 51,532

CROWELL & MORING LLP
Intellectual Property Group
P.O. Box 14300
Washington, DC 20044-4300
Telephone No.: (202) 624-2500
Facsimile No.: (202) 628-8844

DDE/LEC/ejb